Oct. 21, 1969 R. A. CONRAD 3,474,198

PLUNGER TYPE ELECTRIC SWITCH

Filed Aug. 3, 1967 2 Sheets-Sheet 1

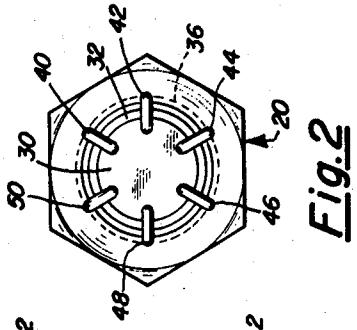

Fig.2

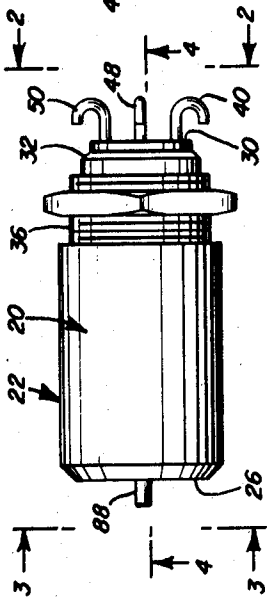

Fig.1

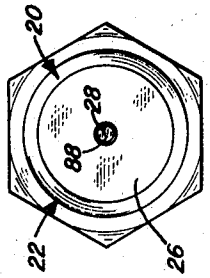

Fig.3

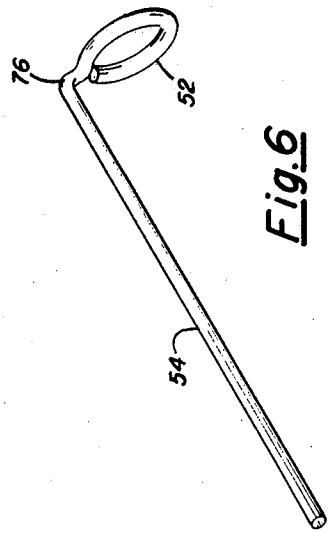

Fig.6

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PLUNGER TYPE ELECTRIC SWITCH

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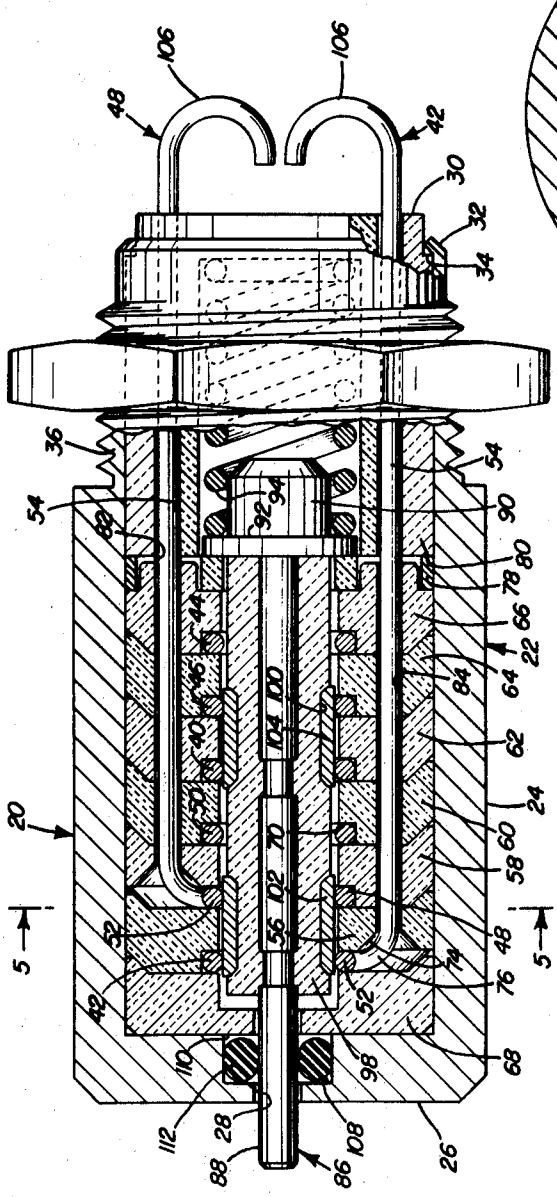

Fig. 4

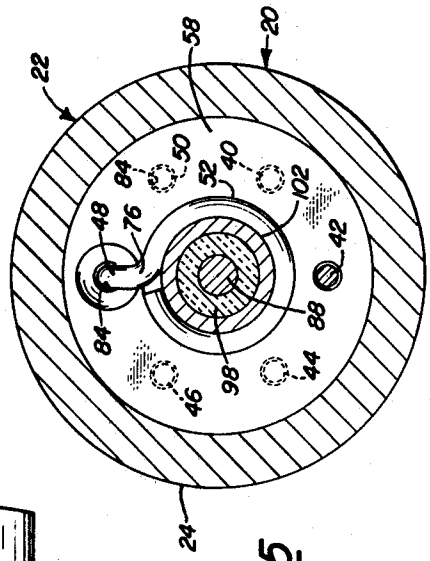

Fig. 5

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United States Patent Office 3,474,198
Patented Oct. 21, 1969

3,474,198

PLUNGER TYPE ELECTRIC SWITCH

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Filed Aug. 3, 1967, Ser. No. 658,148
Int. Cl. H01h 15/06
U.S. Cl. 200—16 7 Claims

ABSTRACT OF THE DISCLOSURE

An electric switch including a shuttle type plunger carrying at least one contact, which contact is adapted to be moved to span at least two transversely disposed sections of stationary conductors, the latter being contained in a housing, and insulated from one another, the stationary conductors each including an integral portion which extends substantially parallelly of the plunger.

The present invention relates to a switch, which switch includes a plurality of insulating members extending longitudinally of one another. These insulators separate two or more transversely disposed sections of stationary conductors, the conductors each including a portion which extends parallelly of the axis of the cylinder, the insulators having openings for receiving those latter portions of the conductors.

The switch includes also a shuttle type plunger which carries a conductor, which is adapted to bridge the transverse sections of the stationary conductor.

The conductor on the plunger or the transversely disposed section of the stationary conductors may be formed of resilient material for biasing relationship. In the embodiment illustrated, at least the transverse sections of the stationary conductors are biased radially inwardly for frictional engagement with the conductor or the plunger.

Other features and the advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the invention is illustrated.

In the drawings:

FIG. 1 is a side view of the electric switch;

FIGS. 2 and 3 are end views looking in the direction of arrows 2 and 3, respectively, of FIG. 1;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 1, but on a larger scale;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4; and

FIG. 6 is a perspective view of one of the stationary conductors.

Referring more in detail to the drawings, the switch 20 includes a frame in the form of a housing 22, which is preferably cylindrical in shape including the cylindrical wall 24, and end wall 26 having an opening 28. The opposite end of the frame includes a cover or cap 30. This housing including the cap may be formed of insulating material, but is herein shown, as being formed of stainless steel. When the cover is formed of steel, the end 32, opposite the end 26 is swagged over a shoulder 34 on the cap 30. The cylindrical wall 24 may be provided with suitably integral formed portion 36 for mounting the switch.

While not limited thereto, the switch includes six conductors 40, 42, 44, 46, 48 and 50, which extend through the end of the cap 30, the ends thereof forming contacts for mating engagement with socket (not shown) having six receiving contacts or for connecting with other conductors. Each of these conductors of the switch is provided with a ring shaped end section 52, which extends transversely of the axis of the cylindrical housing 22 and with the portion 54, which extends parallelly of the axis of the housing.

The sections 52 are separated from one another by hollow insulating members in the form of rings 56, 58, 60, 62, 64 and 66. Since the left most conductor 42 must be insulated from the end wall 26, a ring shaped insulator 68 is interposed between section 52 of conductor 42 and the inner side of the end wall 26 of the housing 22. However, should the housing be formed of insulating material, such insulator ring 68 could be omitted.

Each of the insulating rings 56, 58, 60, 62, 64 and 66 is provided with a circular notch 70 on the inner perimeter for receiving a conductor section 52, and each is provided with a side notch 74 for receiving the curved section 76 of the conductors 40, 42, 44, 46, 48 and 50, which side portion connects the transverse sections 52 with the portion 54, which extends parallelly of the axis of the housing. A metallic ring 78 is interposed between the insualting ring 66 and the left end 80 of the cap 30. This insulating ring is provided with six feed through holes 82 for receiving the six portions 54 of the stationary conductors. These holes are spaced at 60 degrees from one another and at equal distance from the axis of the cylindrical housing 22. The insulating rings 56, 58, 60, 62, 64 and 66 are provided with holes 84, which are aligned with the holes 82 in the insulating ring 78 for receiving the portion 54 of the conductors.

In assembling, the insulating rings and the conductors 40, 42, 44, 46, 48 and 50 are assembled as a unit and then inserted into the housing, or the insulating ring 68 is bottomed against the inside surface of the end wall 26. Thereafter, conductor 42, ring 56, conductor 48, ring 58, conductor 50, ring 60, conductor 40, ring 62, conductor 46, ring 64, conductor 44, ring 66 are added sequentially. Thereafter, metallic ring 78 and insulating ring 80 are added.

The shuttle shaft plunger 86 is concentrially arranged in the housing 22, it includes a shaft 88. The left end extends outwardly beyond the end wall 26 of the housing 22, whereby it may be attached to an actuator (not shown). This plunger is formed of stainless steel and the right end is threaded for receiving a threaded spring seat 90, formed of an aluminum alloy and with a shoulder 92. A spring 94 is interposed between the inside surface of the insulating cap 30 and the shoulder 92, and therefore normally urges the plunger to the left.

A sleeve 98 of insulating material surrounds shaft 88, as for example, by molding the sleeve to the shaft. This insulating sleeve is provided with a plurality of circumferential grooves 100, herein shown as two grooves, which receives cylindrical conductors 102 and 104, which are suitably affixed to the sleeves, as for example, by being molded thereto. As shown in the drawings, the cylindrical conductor 102 has sufficient length so that it can span sections 52 of conductors 42 and 46, or it can span sections 52 of conductors 46 and 48. It can also be moved to a position in which it contacts a section 52 of conductor 46 only. Likewise, circular conductor 104 can span sections 52 of conductors 50 and 40, or span sections 52 of conductors 40 and 42, or can be moved to a position in which it contacts only section 52 of conductor 40.

The inner peripheral surfaces of the sections 52 of the conductors are in frictional engagement with the peripheral surface of the conductors 102 or 104 on the plunger 86. Preferably the conductors 40, 42, 44, 46, 48 and 50 are formed of resilient and flexible material, such as beryllium copper. The inside diameter of the sections 52, when not under stress, is less than the outside diameter

of either of the conductors **102** and **104**, whereby, when in an assembled position, the inner periphery of the sections **52** are in yielding and frictional relationship with the conductor **102** or **104**, i.e., they are normally biased toward the conductor **102** or **104**.

After all the parts are in position, then the cup shaped cap **30** is placed in position for holding the confronting sides of the insulating rings in abutting relationship and, respectively, against the transverse sections **52** of the conductors, the cap being ridgedly held in position, and after, the swagging operation on the ends **32**, all of the insulating rings and the conductors are held in ridged position with the housing.

If desirable, and as shown, the right ends of the stationary conductors are provided with hook ends **106** for suitable connection, as for example, as by solder to other conductors.

The end wall **26** of the housing **22** is provided with an inwardly facing notch **108**, which notch in cooperation with the left end of insulating ring **68** provides a groove **110** for receiving an O-ring **112**, which functions as a seal for the left end of the shaft **88**.

The stationary conductors are of different lengths, so that they all terminate at the same distance from the right end of the housing. It is to be appreciated that the insulating rings **56**, **58**, **60**, **62** and **64** are uniform in construction, thus materially reducing the cost in multiple insulators. The composite switch is simple in construction, sturdy, can be made in minute or large sizes, is simple to assemble, thus materially reducing the cost of manufacture.

I claim:

1. A plunger type electric switch comprising in combination:

(A) a reciprocator shaft including:

(1) an insulated section movable with the shaft,

(2) a conductor having:

(a) a section on the periphery of the shaft and disposed longitudinally of the insulated section and movable with the shaft;

(B) a plurality of separate, stationary insulated members extending longitudinally of one another, each of said members having:

(1) a centrally disposed opening therethrough, said openings being aligned and receiving the shaft,

(2) a plurality of longitudinally extending openings disposed axially outwardly of the centrally disposed openings, certain of said second mentioned openings being aligned to form a set of openings and certain other of said second mentioned openings being aligned to form another set of openings;

(C) a plurality of stationary conductors, each having:

(1) a section extending transversely of the axis of the first mentioned openings (B)(1) of the insulating members and slidably engaged by the first mentioned conductor (A)(2), said last mentioned section being interposed between confronting pairs of the insulating members,

(2) a portion formed integrally with a first mentioned section of a stationary conductor; the portion (C)(2) of one of stationary conductors extending within one of the sets of openings (B)(2) in the stationary insulating members, and the like portion of another of the stationary conductors extending within another set of openings (B)(2) of the stationary insulating members;

(D) means for retaining the insulated members and the stationary conductors in assembled relationship.

2. An electric switch as defined in claim **1**, characterized in that the inner perimeters of the first mentioned openings in the insulating members are each provided with a notch for receiving the transverse sections of the stationary conductors.

3. An electric switch as defined in claim **2**, characterized in that the confronting sides of the insulating members are in abutting relationship.

4. An electric switch as defined in claim **1**, characterized in that the means (D) is a frame.

5. An electric switch as defined in claim **4**, characterized in that the frame includes:

(D)(1) a transversely extending end;

(2) a cap at the opposite end of the frame, said insulating members (B) and stationary conductor sections being interposed between said end (D)(1) and the cap.

6. An electric switch as defined in claim **5**, characterized to include:

(E) a spring interposed between the interior side of the cap and the actuator shaft, said spring being biased to normally urge said shaft in one direction.

7. An electric switch as defined in claim **6**, characterized in that the free end of the contact portion (C)(2) extends into the cap.

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U.S. Cl. X.R.

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